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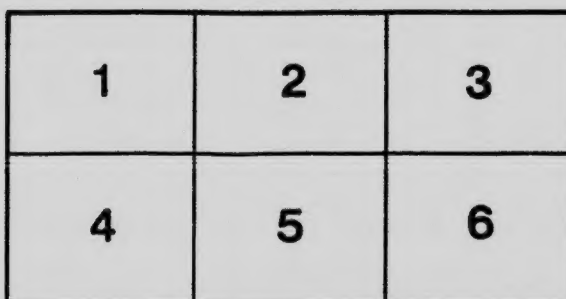
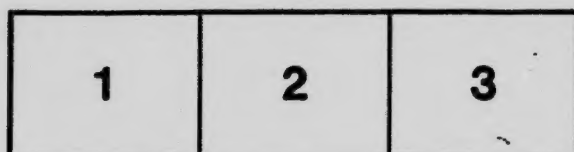
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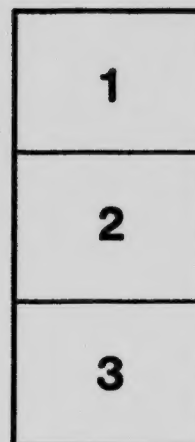
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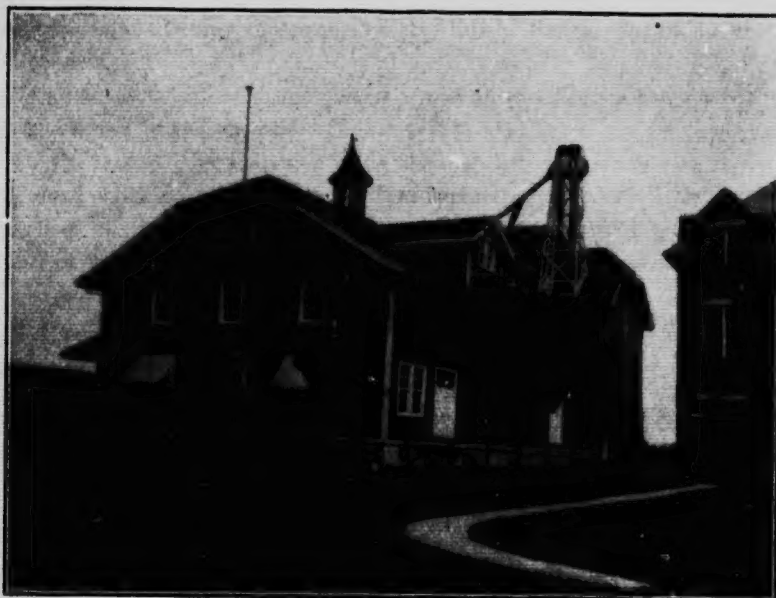
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DEPARTMENT OF AGRICULTURE
DAIRY AND COLD STORAGE COMMISSIONER'S BRANCH
OTTAWA, - - - CANADA

THE GRIMSBY PRECOOLING AND EXPERIMENTAL FRUIT STORAGE WAREHOUSE

- I.—General Notes.
II.—Schedule of Rates.

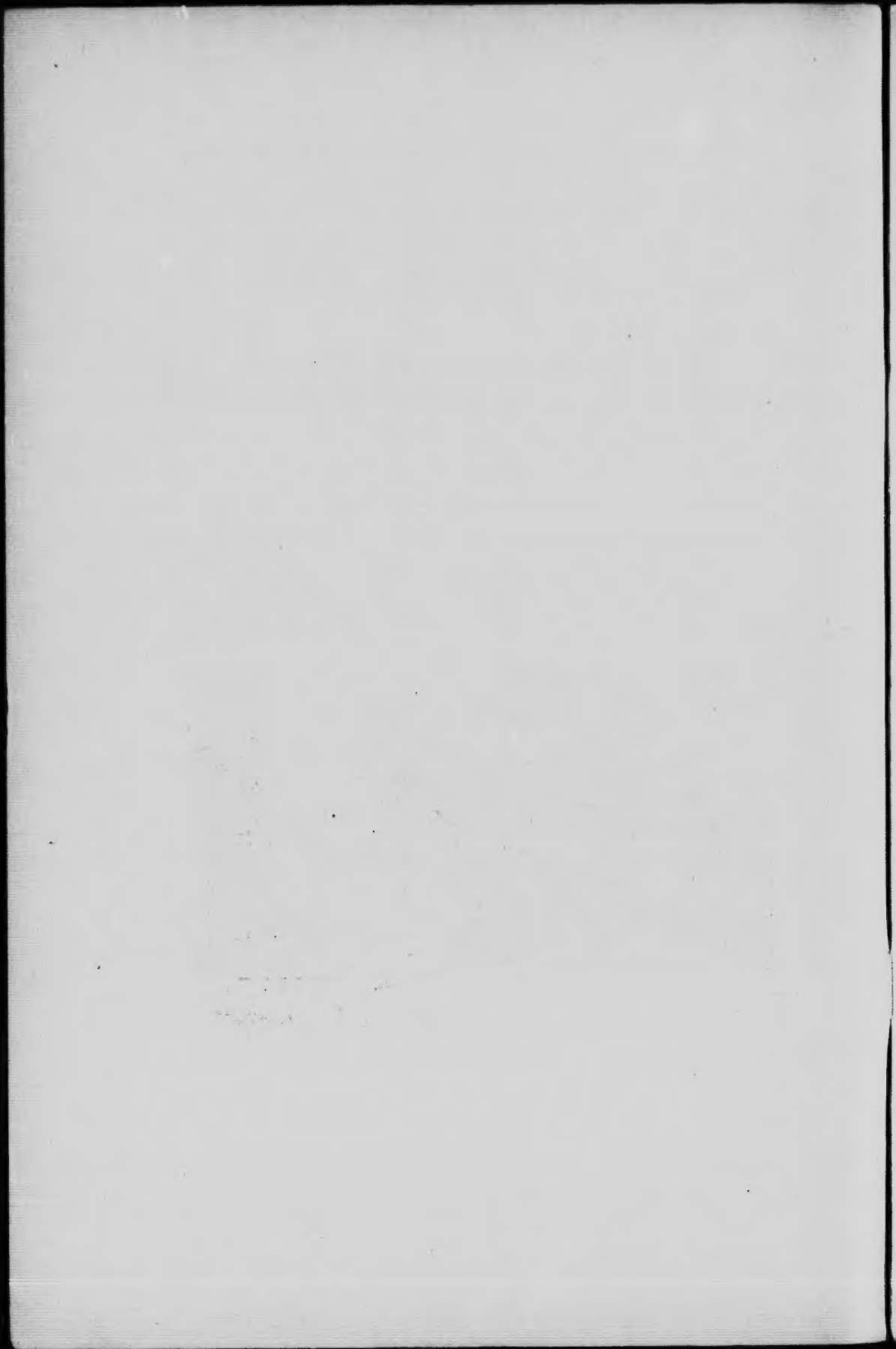


BULLETIN No. 47
Dairy and Cold Storage Commissioner's Series.

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LETTER OF TRANSMITTAL.

OTTAWA, ONT., February 10, 1916.

To the Honourable the Minister of Agriculture,

SIR,—I beg to submit for your approval the manuscript for a bulletin, entitled "The Grimsby Precooling and Experimental Fruit Storage Warehouse," which has been prepared under my direction, by Mr. Edwin Smith, who is in charge of the establishment.

The first part deals with the objects aimed at, and gives a summary of the results already secured in the operation of this plant.

In the second part the rates to be charged for precooling and storage are set forth along with the rules and regulations under which fruit will be handled.

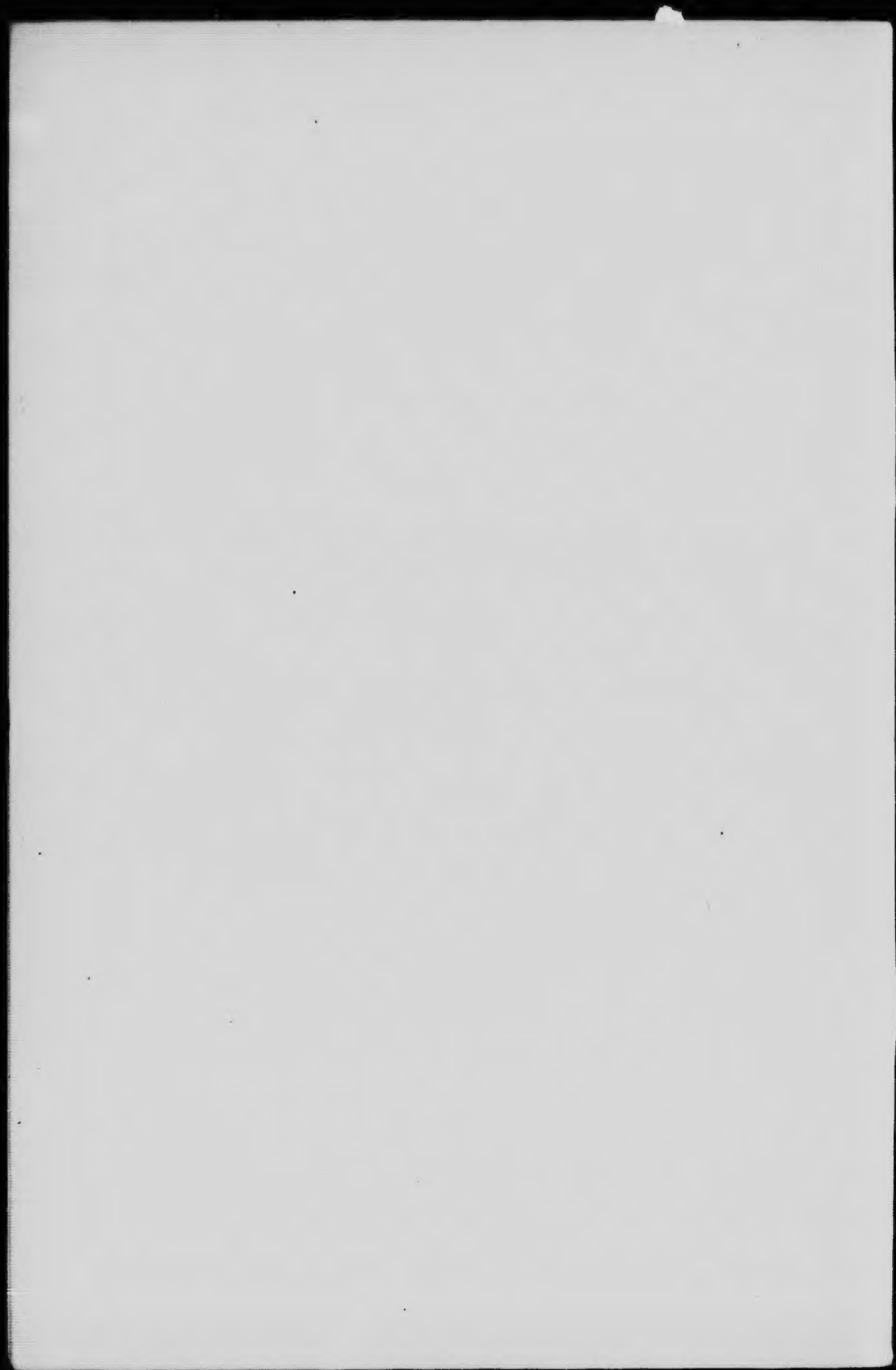
I have the honour to recommend that this manuscript be published as Bulletin No. 47, of the Dairy and Cold Storage Series, for distribution among fruit growers and dealers.

I have the honour to be, sir,

Your obedient servant,

J. A. RUDDICK,

Dairy and Cold Storage Commissioner.



THE GRIMSBY PRECOOLING AND EXPERIMENTAL FRUIT STORAGE WAREHOUSE.

I. GENERAL NOTES.

THE PURPOSE OF REFRIGERATION FOR FRUIT.

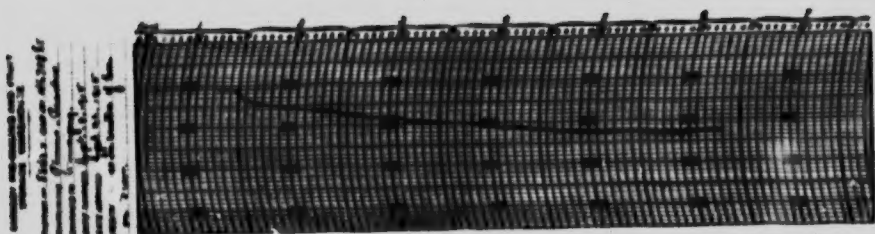
Fruit must be fresh in flavour, texture and appearance to be at its best, and it is to the interest of all who grow and handle fruit to place it before the consumer in such a condition. Temperature is the most important factor affecting the freshness of fruits after picking, and it is largely dependent upon this factor whether or not fruits reach the consumer free from decay and mouldiness as a wholesome food and a pleasing luxury.

The ripening processes in fruits proceed more rapidly at high temperatures than at low temperatures. Science has shown that the rate of these processes is increased twice with every rise of 20° F. in temperature. For this reason the progressive fruit grower should cool his fruit as quickly as possible after picking, and if it is not delivered to the consumer at once, he should hold it at temperatures between 32° F. and 50° F., according to the variety and circumstances. Although these low temperatures do not stop ripening altogether, the processes are greatly checked.

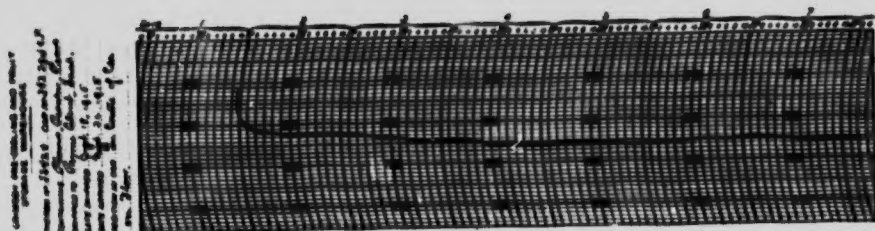
In order that fruits of a very perishable nature may undergo shipments covering a few days, refrigerator cars are in common use for their transportation. In this way fruits and vegetables are held in a cool condition while undergoing continent-wide shipments, and, after sufficient time for cooling, are ordinarily held at a temperature between 40° F. and 50° F. In shipping the more perishable fruits for long distances, the refrigerator car has not been found adequate on account of the long time required to cool the carload of fruit from the outside temperature down to 40° F. During the two or three days thus required, the heat in the fruit has caused ripening to take place with atmospheric conditions growing worse, so that over-ripeness and decay often occur before the load is actually cooled down to the temperature which the refrigerator car is capable of maintaining. This makes it important to have the fruit at a low temperature before shipment; and for that reason various methods for the precooling of fruit have been put into practice.

Many shippers do not realize the importance of low temperatures in refrigerator cars and are satisfied merely to load their fruit in a "freezer" regardless of the temperature and atmospheric conditions that are to follow. The chances of successful shipments are greatly reduced when the fruit is not cooled down until three days after loading, or when the whole journey is made with the temperature of the fruit above 45° F. The efficiency of the refrigerator car should be such that when assisted by precooling the temperature of the fruit may be held uniformly at 38° F. during transit so long as the bunkers are kept full of ice.

The thermograph records shown herewith illustrate the improved temperature conditions in cars of fruit that have been precooled. Note the length of time required to lower the temperature of the fruit in the car not precooled.



No. 55423. Temperature record of a car of fruit not precooled. Shipped West September 18, 1915.



No. 55424. Temperature record of a car of fruit precooled. Shipped West September 18, 1915.

PRECOOLING.

The precooling of fruit simply means any method of reducing its temperature previous to shipment. Much confusion has been caused by the idea that fruit is not truly precooled unless it is first loaded in a refrigerator car and then subjected to a blast of cold air driven through the car mechanically. The important function is the reducing of the temperature of the fruit, *immediately after picking*, to a point that the refrigerator car can maintain, and it matters little whether it is done before or after it has been loaded in refrigerator cars so long as the cooling is done promptly and thoroughly and without injury to the fruit.

Whether fruit is to be precooled in a warehouse or in the refrigerator car depends largely upon shipping conditions.

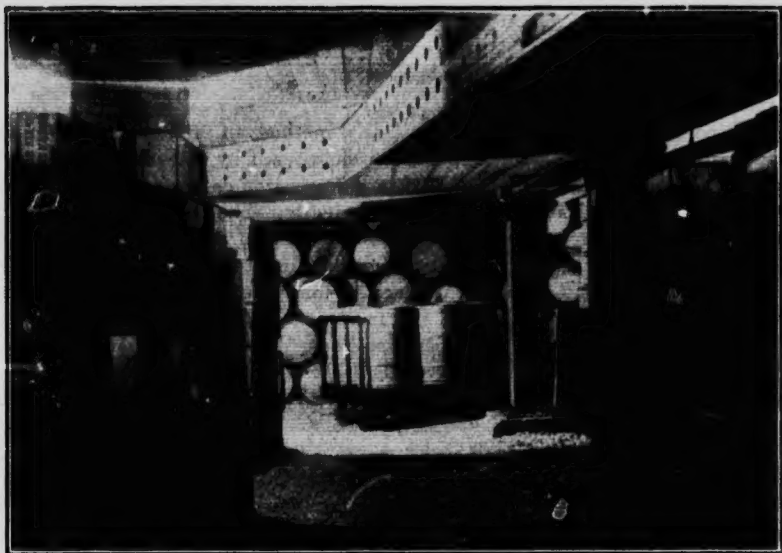
The car precooling plant does the work quickly with a saving of labour in handling, and will serve a wide range of producing territory. Warehouse precooling is adapted to the small shipping point where it is desirable to have cold storage in order that carloads may be made up over two or three days, and where the car-precooling plant would not be feasible on account of the overhead expense. The warehouse type is designed to serve local districts where the fruit is brought in direct from the orchard by the grower and subjected to cooling at once instead of waiting till the full carload is made up. While there is an added expense in receiving and handling in the warehouse type of plant, this is more than over-balanced by economy in the use of refrigeration. In Canada, difficulty would be experienced in using some types of car-precooling plants, since in various districts the brine tank refrigerator car is used. This car is so constructed that a current of air is unable to enter its interior through the hatches.

THE EXPERIMENTAL PRECOOLING PLANT AT GRIMSBY.

During the season of 1914 the Department of Agriculture opened the experimental precooling and fruit storage plant at Grimsby, Ontario. It is strictly a warehouse type of precooling plant, using the Cooper Brine System for refrigeration. Exclusive of corridors, passageways, and experimental space, there are 27,000 cubic feet of refrigerated space. For precooling purposes there are four rooms, each of which is capable of holding one carload of fruit loaded on trucks. The four rooms are severally equipped with Cooper's system of forced air circulation and with electrical distance thermometers, to facilitate the regulation of the temperature. The plant is designed to precool fruit from 70° F. to 40° F. in 24 hours. Owing to the time required for receiving and shipping this cuts down the capacity of the plant to about three carloads per day. The warehouse has auxiliary storage to assemble eight additional cars of fruit.

The fruit upon being brought in warm from the orchards is loaded on specially designed trucks, run into the precooling rooms and cooled without removal therefrom, by a circulation of cold air introduced through a perforated false floor. The air is cooled by passing over brine coils the temperature of which is held at about 10° F. The brine within the coils is chilled by the rapid melting of the ice mixed with salt which surrounds that part of the system known as the primary coils.

The cooling is done chiefly at night and proceeds till the temperature of the fruit is reduced to 40° F., when the trucks are wheeled out of the precooling rooms through the cold corridors and adjustable car-door vestibule into the refrigerator car where it is loaded under ice. The fruit is not exposed to warm air after once being cooled, and, if the refrigerator cars are efficient and properly taken care of en route, remains in a cold condition until it arrives at its destination.



Fruit Storage Room.



Trucks used in Precooling Rooms.

Loading is done by trained men according to methods that are approved by experience. For distant shipments the cars are provided with slatted floors. The purposes of these temporary floors are to hold the load of fruit up off the floor so as to allow the cold air to circulate from the ice bunkers towards the centre of the car and up through the load of fruit, and to raise the packages of fruit out of danger of wet should meltage flow from the ice bunkers over the car floor. After loading, the packages are securely braced, which goes a long way to insure the arrival of the fruit in good condition. The cracks about the doors are sealed with a good grade of sulphite paper.

RECORDS OF TEMPERATURES IN TRANSIT.

In special shipments, or in ordinary shipments where the shippers especially desire it, a thermograph (recording thermometer) is placed in the car, and continuous records are thereby obtained of the temperature of the interior of the refrigerator car from the



Thermograph with cover raised.

time it leaves the precooling plant until it arrives at its destination. This is very important, for it gives useful information as to the temperature conditions to which shipments are subjected, while at the same time it makes a record as to the despatch of the car.

RESULTS AND OBSERVATIONS COVERING TWO YEARS.

Some of the advantages that the plant has shown to the local growers and shippers are:—

1. The assembling of carloads of cherries, peaches, plums or other tender fruits over two or three days, and shipping by refrigerated freight while in good condition.

2. The prevention of loss from decay and over-ripeness, by checking the ripening of fruit through prompt precooling.

3. The extension of markets over a wider area, by being permitted to make shipments to more remote parts.

4. Increased returns, by being able to deliver perfect and sound fruit in competition with fruit arriving in inferior condition.

5. The saving in transportation charges through shipping by refrigerated freight rather than by express (\$250 per car may be saved in transportation charges to Winnipeg).

6. The holding of tender fruits for several days to suit the market's demands and orders.

7. The avoidance of glutted markets.

8. The extension in the length of the marketing season of early apples and pears over several weeks.

9. The reduction of loss from decay and over-ripeness in the storage of winter apples.

PRECOOLING AND ITS RELATION TO THE EXTENSION OF TENDER FRUITS MARKETS.

The precooling work at Grimsby is divided into: (1) commercial cold storage and the precooling of fruit for the general public; (2) demonstrations in fruit handling, packing, precooling and transportation; (3) experimental refrigeration tests.

STRAWBERRY PRECOOLING.

The precooling of strawberries on long-distance shipments has been limited to one commercial shipment to Winnipeg. The berries for this shipment were picked after heavy rains, and had a tendency towards softness. They were precooled to 40°F. and shipped by refrigerated express. The berries arrived at their destination without decay even although the shipment was made in 24-quart crates which are very poor packages for long-distance shipments. The trial was a success from a physical standpoint, and further trials will be made to determine if this method of shipment can be followed commercially with success.

Experiments with the maturity of strawberries for precooled shipments indicate that while ripe strawberries lose in texture and will not stand the package pressure for the length of shipment, on the other hand berries that are picked green will advance but little in colour when precooled and shipped under refrigeration. For this kind of shipment, strawberries must show some colour but must still be firm when picked.

Strawberries may be held at 32°F. for a period of four or five days and successfully marketed locally.

RASPBERRIES.

The successful refrigeration of this fruit is largely dependent upon the variety and the district in which it is grown. Undoubtedly the Cuthbert is the most satisfactory variety for handling, but when grown under Ontario conditions it does not have the same shipping stability as the same variety grown in the Pacific Coast districts. In Ontario the raspberry may be held for four days at 32°F. This is important at week ends and at times when markets are over-crowded.

CHERRIES RESPOND TO PRECOOLING.

As a result of the demonstration shipment made in 1914, shipments of sour cherries were increased greatly that year, but at the beginning of the season of 1915 a carload shipment of cherries to Winnipeg was made up jointly with the Grimsby

Fruit Growers, Ltd., and the Winona Fruit Growers, Ltd., including Early Richmonds and a few Black Tartarians. This shipment was important for three reasons: (1) The Early Richmond is not considered as good a shipper as the Montmorency; (2) it tested sweet cherries on freight shipments to the West; (3) it gave sour cherries a ten days' shipping test. As all lots arrived in Winnipeg in good condition it showed that Early Richmond cherries could be precooled and shipped west as well as Montmorencies, standing a shipping test of ten days, and it showed that sweet cherries may also be precooled and shipped west.

PRECOOLED CHERRIES STAND UP WELL.

To demonstrate how precooled cherries stand up after withdrawal from refrigerator car, a part of the experimental shipment was reshipped by ordinary express to Brandon and arrived there in good condition, selling for a higher figure than those sold in Winnipeg.

Cherries that have been picked for 10 days will not stand up as well as freshly picked fruit even though they have been under refrigeration. Ripening processes take place slowly under refrigeration, and thus lower the vitality of the fruit. However, cherries will not immediately perish upon withdrawal from refrigeration, and if they have not been under refrigeration for more than 8 or 10 days most varieties will stand up long enough for marketing. Upon first withdrawal from the refrigerator car there is a rapid condensation of moisture upon the surface of the fruit (not so heavy on the prairies as in the East on account of the low relative humidity of the air in the West). This moisture gradually disappears, but the moisture and heat combined always tend to germinate mould spores. During the day of unloading and distribution the cherries remain in good condition without much sign of change. After twenty-four hours from the car, or on the following morning the fruit will appear in as good condition, but upon careful examination will show discoloured spots, especially where it has been bruised. After thirty-six hours the discoloured spots begin to show decay which begins to be serious after two days from the car unless kept in cold storage.

GOOSEBERRIES.

Gooseberries may be readily included in precooled shipments as they stand refrigeration and shipping well. At 32° F. they remain in good condition for four weeks, and at a refrigerator car temperature will not perish under two weeks.

BLACK CURRANTS.

Black currants also stand refrigeration well, and by precooling may be shipped to Manitoba and Saskatchewan. At 32° F. they may be stored for a period of two weeks, and at a refrigerator car temperature remain in good condition for 10 days. However, if shipped in the larger baskets there is a tendency to develop a fine mould growth throughout the package.

RED CURRANTS.

By packing in berry crates the red currant may be included in precooled shipments to prairie points. At 32° F. it may be stored for from 10 days to two weeks, and at 40° F. remains in good condition for from 6 to 8 days.

PLUMS.

The precooling of plums has been very successful from the first. Shipments of 1915 were very active and gave universal satisfaction. More care is being given to the maturity and condition of the fruit at picking time, and this has augmented the

precooling work to such an extent that precooled shipments of plums have become very popular. The greatest distance that precooled plums have been shipped were to Prince Albert, Saskatchewan, and to Glasgow, Scotland.

Plums retain their flavour and texture under refrigeration better than any of our tender fruits, and during the past year shippers have had all fears allayed that had previously made them very sceptical as to the keeping quality of precooled plums. Our experimental tests with the plum varieties have been made to determine which varieties are suitable for long distance shipments after precooling. The following have proven most satisfactory: Bradshaw, Monarch, Grand Duke, Reine Claude, Damson, Abundance and Burbank.

These varieties may be held in storage at 32° F. for local markets for a period of one week to three weeks depending upon the variety.

TOMATOES.

Much difficulty has been experienced in shipping tomatoes to the western provinces, due largely to a lack of tomato shipping information and standards. Thus far precooling has not helped to any extent to fix these standards, since not enough time has elapsed for shippers to get acquainted with this manner of shipping. When picked firm enough for ordinary shipments, tomatoes have not coloured enough for a precooled shipment; and when picked ripe enough for local shipments, often times they have been too ripe for carrying long distances. Demonstrations during 1915 have shown that the question of maturity is most important. In precooled shipments, tomatoes must be well advanced in colour, otherwise they will arrive on the market pale and unattractive; on the other hand the tomato must be firm enough to stand the necessary package pressure which it will be exposed to during so long a carriage. The tomato must also be free from cracks or stem punctures, and it has been noticed that tomatoes packed without stems are thus removed from the danger of stem puncture and carry more satisfactorily.

The better varieties of tomatoes, such as Chalk's Jewel, Bruce's First and Best, and Danish Export, may be stored at a temperature of 32° F. for 2 weeks. These varieties will stand a refrigerator car temperature of 40° F. for about 10 days.

PEACHES.

Although shipments of precooled peaches have not been large, those made have been successfully handled. Demonstrations have shown that the Ontario peach may be shipped to any part of the Dominion through precooling. A test was made to show the possibilities of precooling the Early Crawford in which this variety was under refrigeration for two weeks and arrived in Winnipeg in good condition. A successful shipment of Elbertas was made to Glasgow. The farthest western shipment was successfully made to Prince Albert, Saskatchewan.

Tests with regard to the maturity of peaches for precooled shipments show that a peach must not be green at the time of picking, but must be picked before showing any indications of softening, as ripe peaches become mealy, lose flavour and are practically worthless when held for any length of time under refrigeration. Tests have shown that such varieties as Belle of Georgia, Yellow St. John, Early Crawford and Elberta, if properly picked and packed, may be precooled and shipped to nearly any part of Canada.

It has been shown that the marketing season of most varieties of peaches may be lengthened from 1 to 3 weeks by holding them under refrigeration. In this way late orders have been taken care of by shippers who command higher prices and thus increase total sales.

PEARS.

The marketing season of tender varieties of pears, such as the Bartlett, may be lengthened 2 to 6 weeks by placing them in cold storage at 32° F. In this way markets are not over-crowded at the height of the picking season, and increased prices are realized after the rush is over. Similarly the better keeping varieties of pears may have their season extended from 6 weeks to 2 months.

EXTENSION OF MARKETS.

Demonstrations thus far carried on with the better varieties of our tender fruits, excepting berries, have shown that they may be shipped to remote parts of the Dominion without decay or waste. With sour cherries, this extended radius of shipping increased for the West as much as 900 per cent in one year's time. Local markets were thus kept from being glutted, and a strong demand was maintained for the entire season. This extension of markets has not been felt with other tender fruits for the reason that demands for them must be created in local markets. The reason for this is that western markets are, at present, importing the bulk of their tender fruits from the United States. The importation of fruit for these markets has become an established



Refrigerator Car. Doors sealed with building paper.

trade and one that is hard to compete with. During 1913 when tons of tender fruits rotted on the ground in Ontario for want of markets and when calamity stared the fruit grower in the face, the Dominion of Canada imported from the United States 12,149,207 pounds of peaches, 6,197,700 pounds of plums, 6,026,692 pounds of grapes, and 11,054,228 pounds of pears, apricots, quinces and nectarines—or an equivalent of 1,767 carloads of tender fruits. The importation of tender fruits from the United States has made a steady increase and during the past year amounted to over 1,900 carloads.

The statistics of this trade indicate that a large proportion of these importations go into our prairie markets. For three weeks during the peach rush of the past season arrivals in Winnipeg ran as follows:—

	Imported. Carloads.	From Ontario. Carloads.	From British Columbia. Carloads.
First week.. . . .	36	13	10
Second week.. . . .	22	10	16
Third week.. . . .	25	10	13
Totals.. . . .	77	33	44

Points farther West have been consuming imported fruit at a rate to make comparisons even more striking.

The Ontario peach is not largely used in the prairie provinces owing to the heavy purchases of Washington Elbertas by the wholesale trade early in the season. The trade prefers to purchase Washington Elbertas as against Ontarios because of their earlier season, dependable packing and formerly because of their lower cost. Because of the past failures in shipping, it is now difficult to make f.o.b. sales of Ontario peaches to the western trade, and it is going to be very difficult to capture even a small part of the peach trade from the United States. However, by proper packing in boxes and by precooling, successful shipments may be made to the prairie markets without incurring loss, and may be also made at prices lower than can be secured in the United States.

The only way that the western trade can be interested is to show them that they can secure a better article for less money in Ontario than in the state of Washington. By pre-cooling and proper packing this can be done.

With plums the same competition is not to be felt, and without doubt there is a tremendous market for this fruit. One shipper with experience in western markets has stated that by systematic salesmanship the entire Ontario cherry and plum crops could be marketed in the prairie provinces with greater net returns than are now being received in the eastern markets, on condition that all the shipping points be supplied with precooling facilities.

FRUIT PACKING DEMONSTRATION.

The Grimsby experimental plant has on its staff members who are qualified to give instructions as to modern fruit packages and methods of packing. The services of these instructors are always at the disposal of fruit growers when it is consistent for them so to devote their time. Instruction in packing will be given at the experimental packing room or at the grower's orchards. It is always advisable to get information as to the most suitable package before making pre-cooled shipments to new markets.

THE COLD STORAGE OF APPLES.

Apples should be placed in storage when well matured but still hard. This means that winter apples should not be ripe enough for eating and that fall apples should not be soft ripe at the time of storage.

Apples that are well coloured will, other conditions being equal, keep better in cold storage, than greener ones of the same variety.

Only the best quality of fruit and packs should be selected.

Fruit should be stored *immediately after picking*.

Apples wrapped and packed in boxes store better than those packed otherwise.

Apples for storage should be handled carefully and should be free from blemish and skin punctures.

At the Grimsby cold storage apples are stored at the most approved temperature of 30-32°F. Apples are piled according to their approximate date of removal. Different grades and varieties will be kept separate as far as possible, providing the grades and varieties are marked on the outside of the package. The name of the owner of the fruit must also be indicated on the outside of the package.

II.—SCHEDULE OF RATES FOR 1916.

FOR PRECOOLING.

	Each. Cents.
6 quart baskets.....	3
9 ".....	11
11 ".....	14
13 ".....	24
15 ".....	24
One-half pear case.....	24
Apples in boxes.....	4
Apples in barrels.....	10
20 pound plum crate.....	24
24 quart basket berry crate.....	4
24 pint berry crate.....	24
Standard peach box.....	2

FOR STORAGE.

6 quart baskets, month or less.....	14
9 " ".....	2
11 " ".....	24
13 " ".....	24
15 " ".....	24
Peaches in boxes, month or less.....	24
One-half pear case, month or less.....	24
Berries, 24 quart crate, month or less.....	4
Apples, in boxes, season rate.....	15
" per month.....	5
Apples, in barrels, season rate.....	40
" first month.....	15
" each succeeding month.....	10
Minimum charge.....	25

Season rate on apples ends May 1, and unless the owner otherwise signifies the season storage rate will apply.

The above rates cover the receiving, handling and loading of fruit, with necessary clerical work in making out receipts and car tallies for growers and shippers.

Charges for false floors, car bracing, slatting and sealing of doors are based only on cost of material and time of workmen in making up the same.

The above rates supersede and cancel all previous rates.

RULES AND REGULATIONS.

1. The management will attend to loading, billing and sealing of cars, for which there is no extra charge except when bracing, slatting or lining of cars is necessary, when the shipper is charged with actual cost of material and time.

2. All cars, with the exception of those loaded with fruit in barrels, for western or export shipments, will be braced in the centre. The floors will be slatted when necessary. The management reserves the right to decide whether cars should be "slatted" or not. The approximate cost of slatting and bracing will be given upon application.

3. Settlement for charges according to statements rendered will be made with the Grimsby Cold Storage. Cheques should be made payable to the Department of Agriculture.

4. Application should be made in writing to the Grimsby Cold Storage, for space to pre-cool carload lots, at least twenty-four hours before the fruit is to be received at the storage. Applications for pre-cooling space will be accepted in order of priority. Reservations for pre-cooling space not used will be charged for at the rate of \$12 per car, unless said reservations are cancelled at least twenty-four hours before date reserved for.

5. Fruit will be received between 8 a.m. and 12.30 p.m. and between 1 p.m. and 6 p.m. on all week days excepting Saturday, when closing time is 5.30 p.m. Exceptions to this rule will only be made under special circumstances.

6. Shipments of warm fruit will not be made with pre-cooled fruit, as this is conducive to bad results. All warm fruit for pre-cooled shipments must be brought to the plant the day before shipment.

7. Shipping orders must be in the hands of the manager by noon of the day of shipment, otherwise shipment is not guaranteed for that day.

8. It requires but twenty-four hours or less to pre-cool a car of fruit. If fruit is not shipped within twenty-four hours from the time of receiving, storage rates automatically go into effect on that parcel of fruit, in place of the charge for pre-cooling.

9. It is not advisable to hold tender fruits in cold storage for a period longer than four days prior to shipment to the northwest. To prevent unjust discrimination against "pre-cooled fruits" or other false impression that may arise in the fruit trade from such faulty harvesting and shipping methods as over-ripeness at picking time, injuries from handling, poor packing, delay in shipping, etc., the Department of Agriculture reserves the right to notify consignees of the condition of the fruit at the time of shipment.

10. The Department of Agriculture will be responsible only for the number of packages received when the shipper's name is marked or stamped upon each package. Grades and varieties of fruit will be kept separate as far as possible when the packages bear distinguishing marks.

11. Growers bringing fruit to the plant for a shipper will be given a receipt for the lot, a duplicate will be sent to the shipper and a triplicate filed in the office of the cold storage, from which a daily balance sheet will be made for the convenience of shippers assembling cars from storage stock.

12. Shippers will be furnished with a tally sheet of each carload shipment and will sign a receipt for all fruit shipped from the plant.

13. Cold storage space for apples should be applied for in advance.

EDWIN SMITH, B.Sc.,

In charge, Grimsby, Ont.

J. A. RUDDICK,

Commissioner, Ottawa, Ont.